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NOTICE OF ALLOWANCE AND FEE(S) DUE

32615 7590 06/30/2008

OSHA LIANG L.L.P./SUN
1221 MCKINNEY, SUITE 2800
HOUSTON, TX 77010

EXAMINER

WILL ZHENG

ART UNIT

PAPER NUMBER

2192

DATE MAILED: 06/30/2008

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|-------------------------|------------------|
| 10/784,753 | 02/23/2004 | John L. Gustafson | 33226/367001; SUN040407 | 2205 |

TITLE OF INVENTION: METHOD AND APPARATUS FOR ACCURACY-AWARE ANALYSIS

| APPLN. TYPE | SMALL ENTITY | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE |
|----------------|--------------|---------------|---------------------|----------------------|------------------|------------|
| nonprovisional | NO | \$1440 | \$0 | \$0 | \$1440 | 09/30/2008 |

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. **PROSECUTION ON THE MERITS IS CLOSED.** THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN **THREE MONTHS** FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. **THIS STATUTORY PERIOD CANNOT BE EXTENDED.** SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
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 or Fax **(571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

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HOUSTON, TX 77010

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

| |
|--------------------|
| (Depositor's name) |
| (Signature) |
| (Date) |

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| EXAMINER | ART UNIT | CLASS-SUBCLASS |
|------------|----------|----------------|
| WEI, ZHENG | 2192 | 717-130000 |

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB-122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB-47; Rev 03-02 or more recent) attached. Use of a **Customer Number is required.**

2. For printing on the patent front page, list

- (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, 1 _____
 (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 _____
 3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☐ Issue Fee
☐ Publication Fee (No small entity discount permitted)
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4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date _____
 Typed or printed name _____ Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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| WU, ZHENG | | | | |
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1221 MCKINNEY, SUITE 2800
HOUSTON, TX 77010

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 800 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 800 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Notice of Allowability

Application No.

10/784,753

Examiner

ZHENG WEI

Applicant(s)

GUSTAFSON ET AL.

Art Unit

2192

- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 04/02/2008.
2. ☒ The allowed claim(s) is/are 1-3, 5-8, 10-15, 17, 30-32, 34, 35 and 37 (re-numbered as 1-20).
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some* c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
(a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
(b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413),
Paper No./Mail Date _____
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

/Tuan Q. Dam/
Supervisory Patent Examiner, AU 2192

DETAILED ACTION

Remarks

1. This office action is in response to the appeal brief filed on 04/02/2008
2. Claims 9, 16, and 36 have been cancelled by the Applicants' amendment
3. Claims 1, 3, 4, 6-8, 10, 11 15, 30, 32, 33, 35 and 37 have been amended by the Applicants.
4. Claims 4 and 33 are now being cancelled by the Examiner and incorporated into claims 1 and 30.
5. Claims 1, 5, 6, 30 and 34 are now being further amended by the Examiner.
6. Claims 1-3, 5-8, 10-15, 17, 30-32, 34, 35 and 37 remain pending and now being allowed (re-numbered as claims 1-20)

EXAMINER'S AMENDMENT

7. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.
8. Authorization for this examiner's amendment was given in a telephone interview with Robert P. Lord (Reg# 46,479) on 06/20/2008 to obviate any potential 35 U.S.C. § 112/2nd issues, and to put the claims in condition for allowance.
9. The application has been amended as follows:

IN THE CLAIMS

Please cancel claims 4 and 33, and amend claims 1, 5, 6, 30 and 34 as follows:

Claim 1 (Currently amended):

A method of accuracy-aware analysis of a program, comprising:

obtaining source code for the program comprising a floating-point variable;

instrumenting the source code to associate an accuracy-aware tracking

structure with the floating-point variable to obtain instrumented source code

with functionality to call a runtime logging utility;

compiling the instrumented source code to obtain instrumented compiled code;

executing the instrumented compiled code, wherein executing the

instrumented compiled code comprises executing one of a plurality of

operations on the floating-point variable to obtain a resultant value for the

floating-point variable; and

executing the runtime logging utility to populate the accuracy-aware tracking

structure, wherein for each operation performed on the floating-point

variable, the runtime logging utility is configured to:

increment an operations variable in the accuracy-aware tracking structure

corresponding to the operation performed on the floating-point variable,

determine a scaled mantissa for the resultant value, wherein the scaled

mantissa representation for a floating-point variable corresponds to the

integer represented by the first non-zero digit in the mantissa to the last

non-zero-digit in the mantissa,

compare the scaled mantissa with the resultant value to determine whether the resultant value is exact,

quantify ~~the~~ an error associated with the resultant value when the resultant value is not exact to obtain ~~an~~ the error value associated with the resultant value, wherein the error value is a half unit in last place (HULP) value associated with the floating-point variable, wherein the HULP value is a base of a floating-point representation raised to a power of the number of bits causing the error in the floating-point variable.

store the resultant value, the scaled mantissa, and the error value when the resultant value is not exact, and

store the resultant value and the scaled mantissa when the resultant value is exact.

Claim 4 (cancelled)

Claim 5 (currently amended):

The method of claim [4] 1, wherein the HULP value is determined using information obtained during renormalization.

Claim 6 (currently amended):

The method of claim 3, wherein the error value comprises an upper limit interval variable value or a lower limit interval variable value.

Claim 30 (currently amended):

A computer system for performing accuracy-aware analysis of a program,
comprising:

a processor;

a memory;

a storage device; and

software instructions stored in the memory for enabling the computer system
under control of the processor, to:

obtain source code for the program comprising a floating-point variable;

instrument the source code to associate an accuracy-aware tracking structure
with the floating-point variable to obtain instrumented source code with
functionality to call a runtime logging utility;

compile the instrumented source code to obtain instrumented compiled code;

execute the instrumented compiled code, wherein executing the instrumented
compiled code comprises executing one of a plurality of operations on the
floating-point variable to obtain a resultant value for the floating-point
variable; and

execute the runtime logging utility to populate the accuracy-aware tracking
structure, wherein for each operation performed on the floating-point
variable, the runtime logging utility is configured to:

increment an operations variable in the accuracy-aware tracking structure corresponding to the operation performed on the floating-point variable, determine a scaled mantissa for the resultant value, wherein the scaled mantissa representation for a floating-point variable corresponds to the integer represented by the first non-zero digit in the mantissa to the last non-zero-digit in the mantissa,

compare the scaled mantissa with the resultant value to determine whether the resultant value is exact,

quantify ~~the~~ an error associated with the resultant value when the resultant value is not exact to obtain ~~an~~ the error value associated with the resultant value, wherein the error value is a half unit in last place (HULP) value associated with the floating-point variable, wherein the HULP value is a base of a floating-point representation raised to a power of the number of bits causing the error in the floating-point variable,

store the resultant value, the scaled mantissa, and the error value when the resultant value is not exact, and

store the resultant value and the scaled mantissa when the resultant value is exact.

Claim 33 (cancelled)

Claim 34 (current amended)

The computer system of claim [33] 30, wherein the HULP value is determined using information obtained during renormalization.

--END OF AMENDMENT--

Allowable Subject Matter

10. As Applicants point out at pages 11-12 of argument, the closest cited prior arts of Kolawa (US 6,085,029) and Aberth (Aberth et al., Precise Computation Using Range Arithmetic, via C++), taken alone or in combination, fails to teach or fairly suggest at least the feature of (1) incrementing an operations variable in the accuracy-aware tracking structure corresponding to the operation performed on the floating-point variable, (2) determine a scaled mantissa for the resultant value, wherein the scaled mantissa representation for a floating-point variable corresponds to the integer represented by the first non-zero digit in the mantissa to the last non-zero-digit in the mantissa, (3) comparing the scaled mantissa with the resultant value to determine whether the resultant value is exact, and (4) quantifying an error associated with the resultant value when the resultant value is not exact to obtain the error value associated with the resultant value, wherein the error value is a half unit in last place (HULP) value associated with the floating-point variable, wherein the HULP value is a base of a

floating-point representation raised to a power of the number of bits causing the error in the floating-point variable. In as such manners as in each of independent claims 1, 30 and the dependent claims are allowable for at least the same reasons.

11. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Zheng Wei whose telephone number is (571) 270-1059 and Fax number is (571) 270-02059. The examiner can normally be reached on Monday-Thursday 8:00-15:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tuan Q. Dam can be reached on (571) 272-3695. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Any inquiry of a general nature of relating to the status of this application or proceeding should be directed to the TC 2100 Group receptionist whose telephone number is 571- 272-1000.

Art Unit: 2192

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Z. W./

Examiner, Art Unit 2192

/Tuan Q. Dam/

Supervisory Patent Examiner, Art Unit 2192